



Therapeutic Potential of microRNA-Mediated Osteogenic and Anti-inflammatory Pathways in Peri-implantitis

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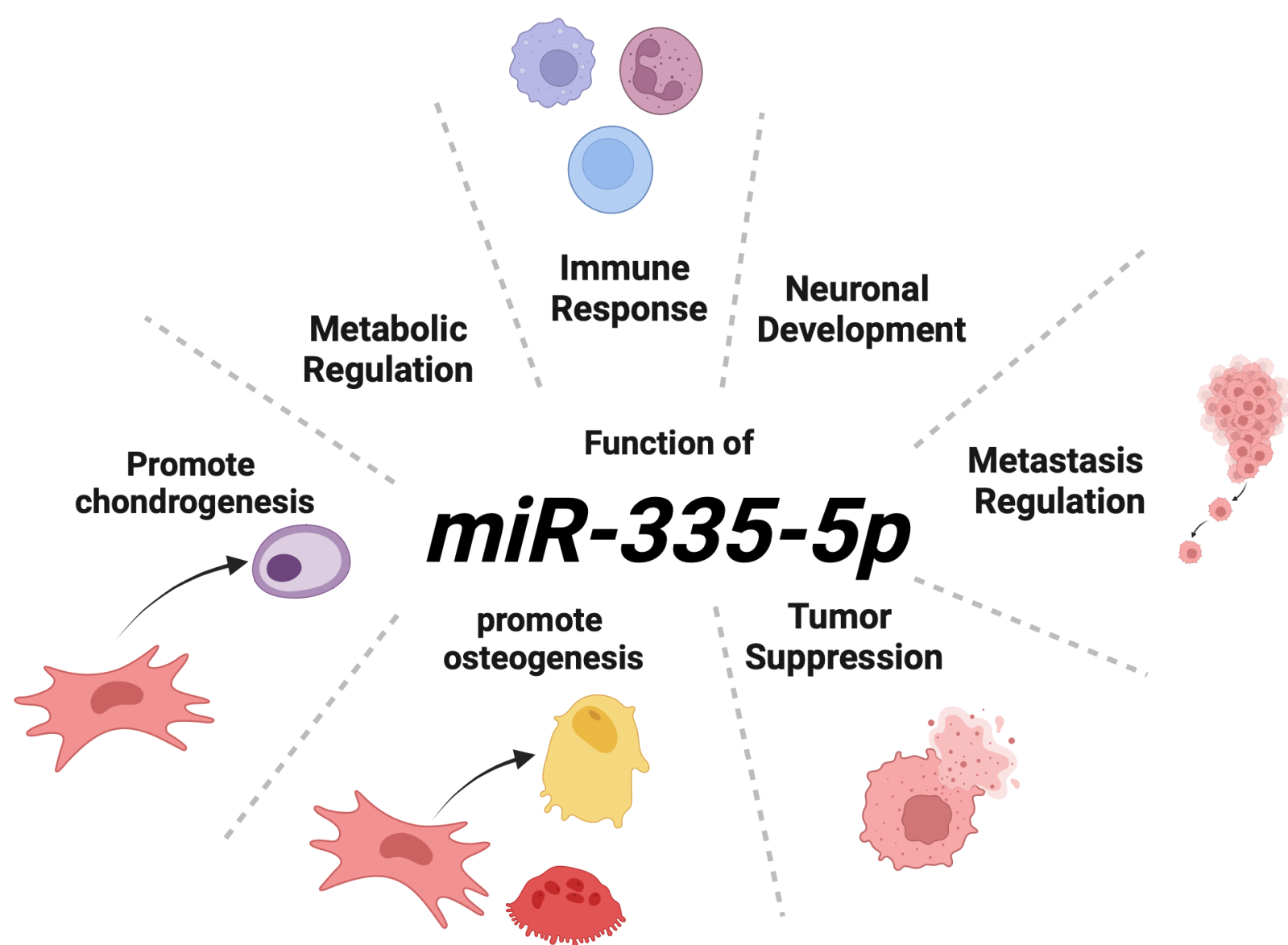
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OBJECTIVE

The objective of this study is to investigate the therapeutic potential of microRNA-335-5p encapsulated in lipid nanoparticles (LNP) for treating peri-implantitis in a rodent model.

MicroRNAs play a role in implant dentistry by serving as biomarkers for predicting clinical outcomes and diagnosing peri-implantitis (Monje et al., 2019). miR-335-5p promotes bone formation and regeneration by suppressing DKK1 expression and activating the Wnt signaling pathway.



Methods

Ligature-induced peri-implantitis model

4-week-old C57BL/6J mice were used in this study. The model was modified from Hiyari et al., 2018. The steps of the experiment are described below.

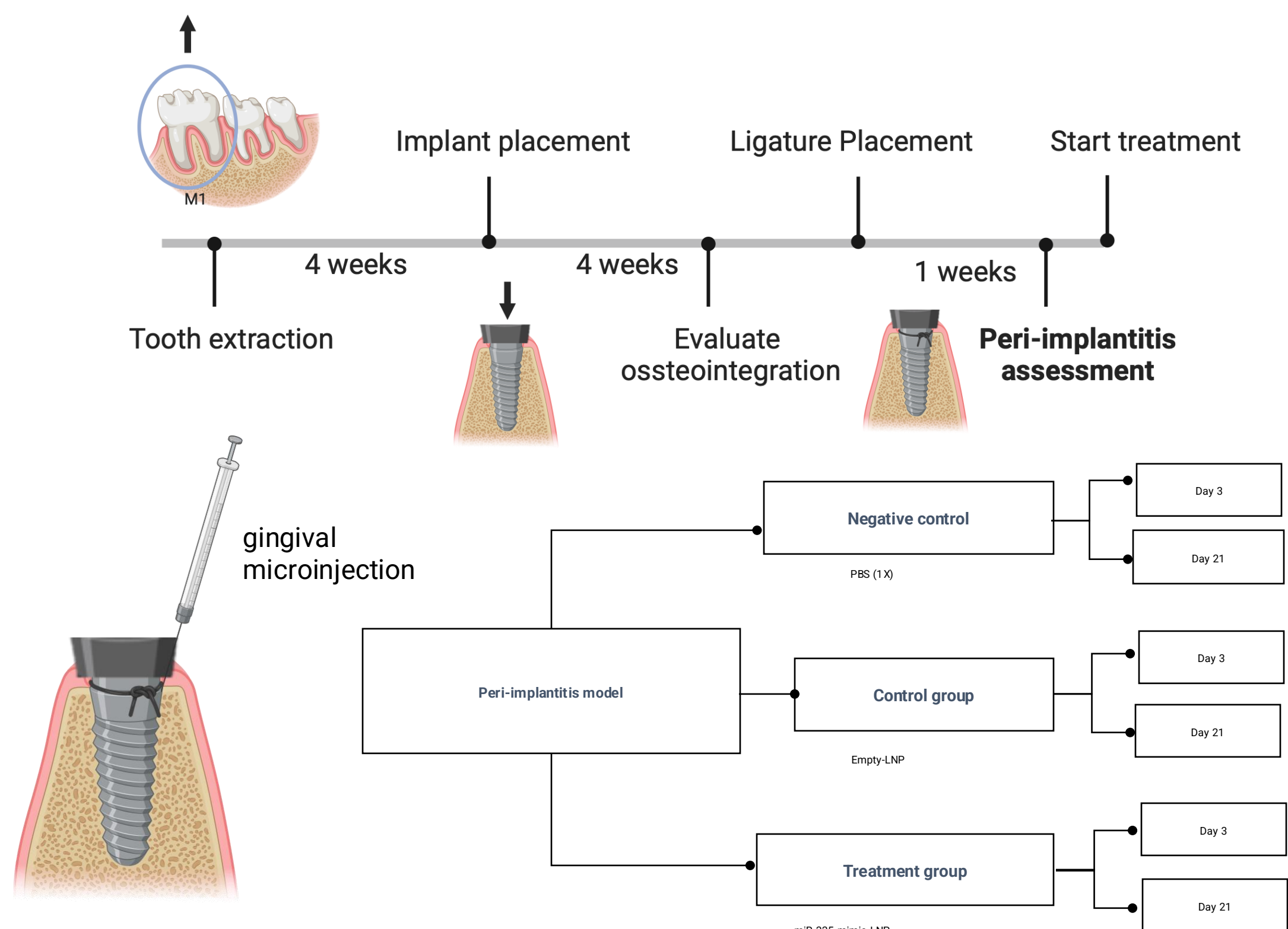


Figure 1. Experimental procedure of ligature-induced peri-implantitis on mice and grouping of study.

Micro-CT analysis

Maxilla were harvested after 21 days of treatment. Mice maxilla were dissected and scanned using Micro-CT for quantification of alveolar bone loss. Distance between the implant head to alveolar bone crest of the alveolar bone was measured mesially, distally, buccally, and palatally.

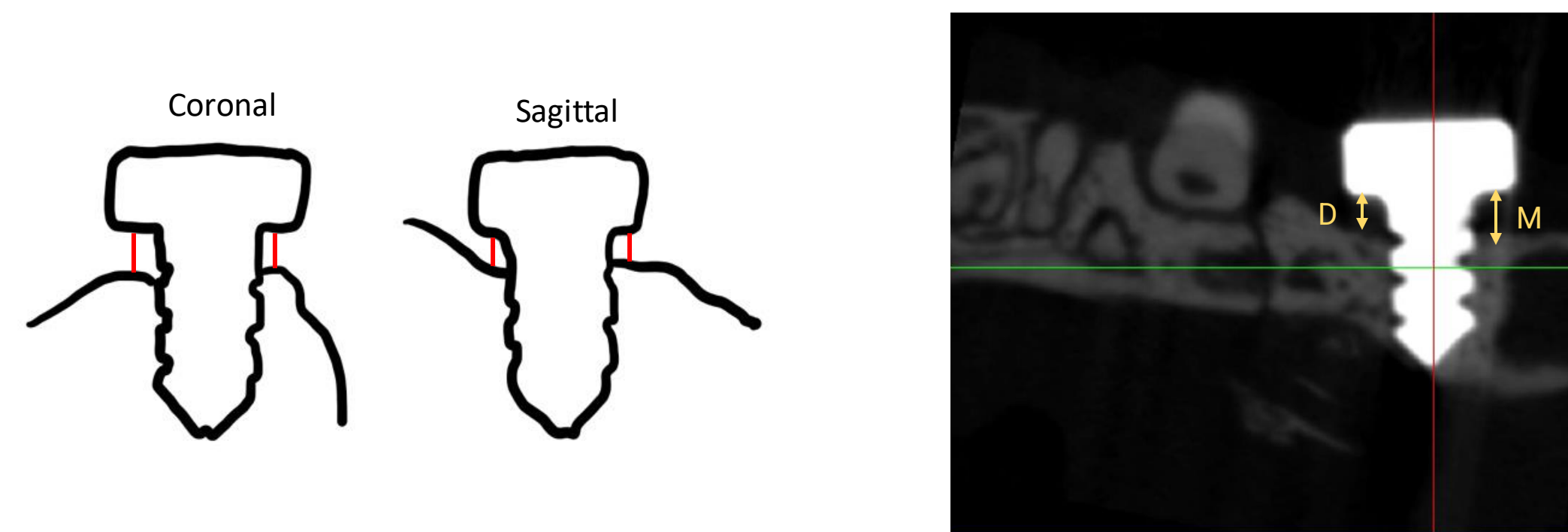


Figure 2. 2D image of implant placed into the alveolar bone. Micro-CT images analysis was measured for the linear distance.

Results

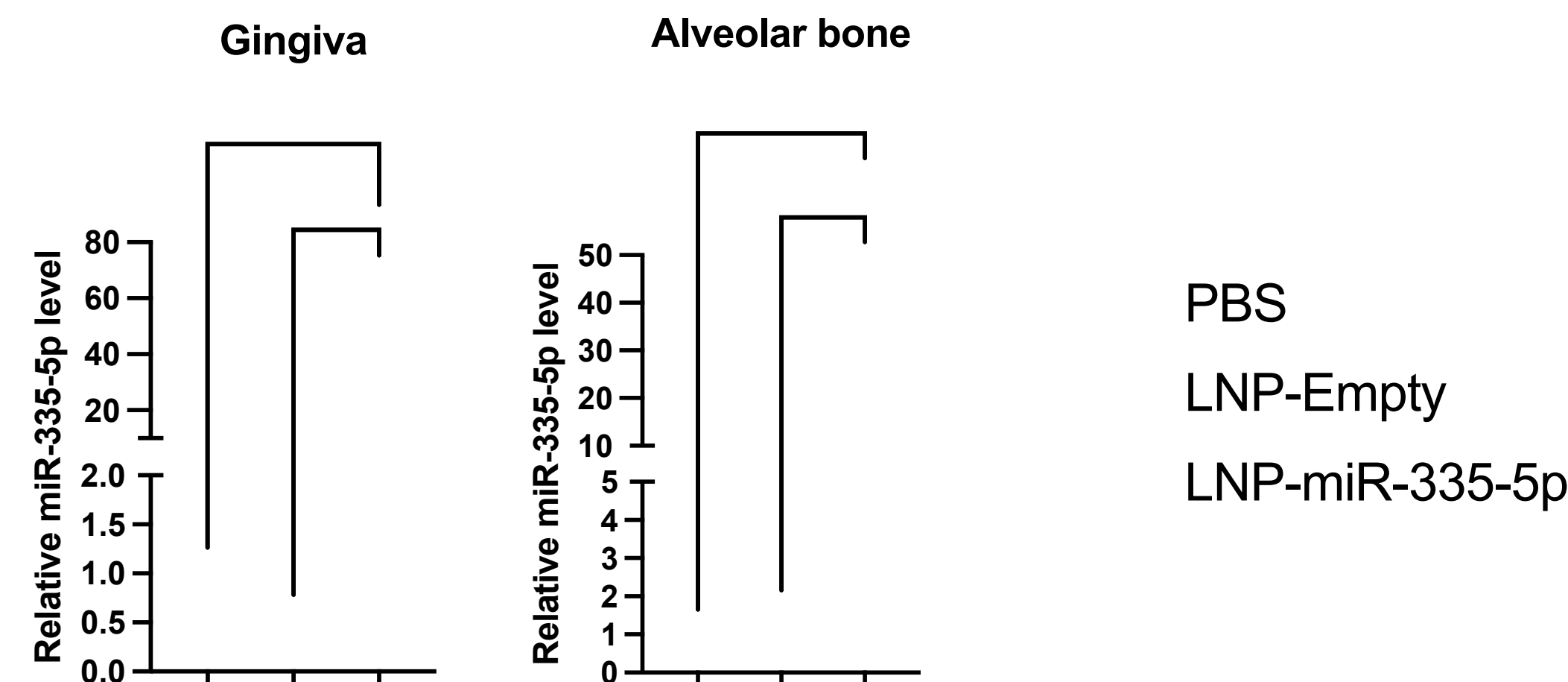


Figure 3. The miRNA-335-5p expression level from gingiva and alveolar bone at Day 3 post-treatment (N = 4/group). One-way ANOVA with post-hoc Tukey's test was performed to determine statistical significance, where * = $p < 0.05$, ** = $p < 0.005$, *** = $p < 0.0005$, **** = $p < 0.0001$

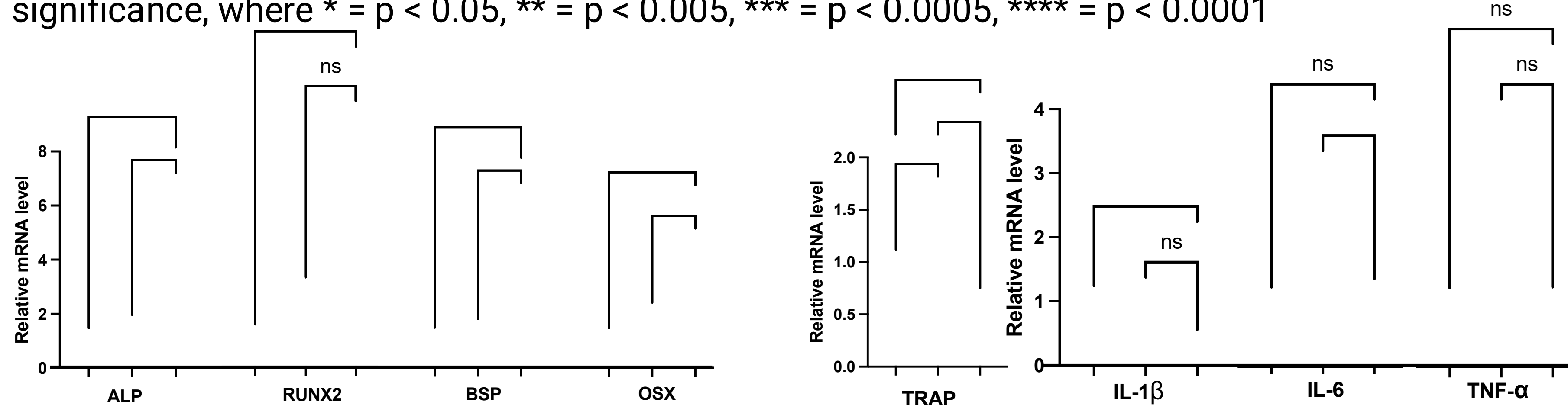


Figure 4. The osteogenic-related and bone resorption markers from alveolar bone samples and pro-inflammatory markers from gingival sample (N = 4/group). One-way ANOVA with post-hoc Tukey's test was performed to determine statistical significance.

Micro-CT Results

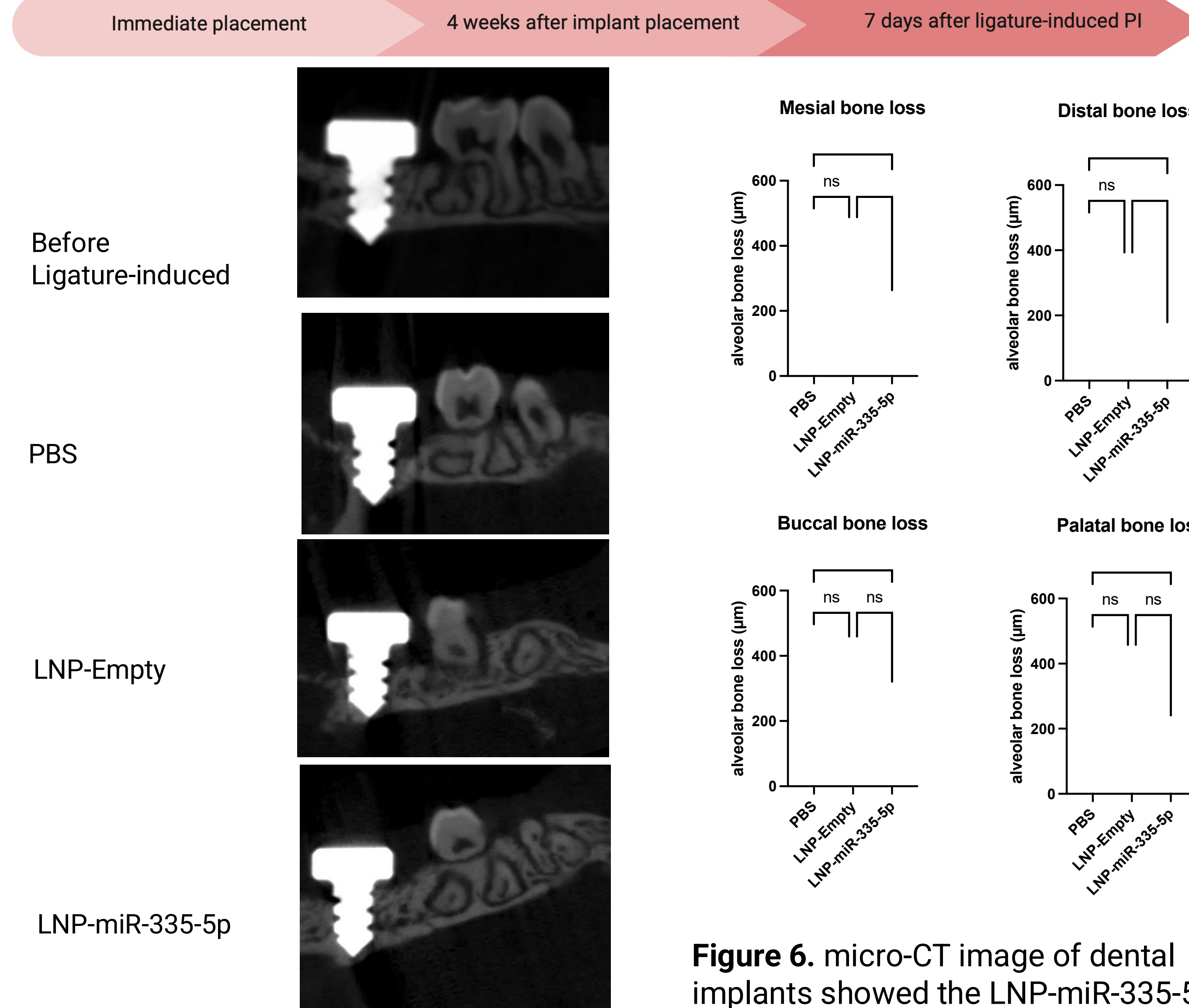
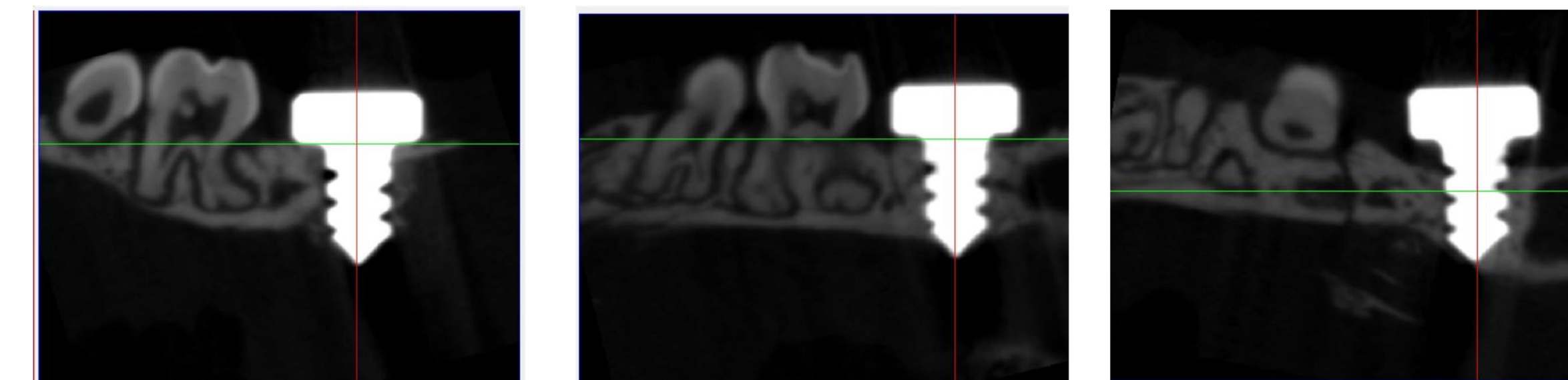


Figure 6. micro-CT image of dental implants showed the LNP-miR-335-5p treated group had less bone loss than other groups. One-way ANOVA with post-hoc Tukey's test was performed to determine statistical significance.

Figure 5. micro-CT image of dental implants showed the LNP-miR-335-5p treated group had less bone loss than other groups.

Conclusion and Future works

- MiR-335-5p-LNP holds promise as a novel treatment modality for peri-implantitis.
- Additional studies are underway on morphological analysis and mechanistic study of molecular pathways by which miR-335-5p exerts its anti-inflammatory and osteogenic effects, as well as the long-term effects of miR-335-5p-LNP administration in treating peri-implantitis.